Handling and Care of Crystal Scintillation Detectors

Unpacking Instructions –

CAUTION . . . DO NOT OPEN PACKAGE UNTIL DETECTOR REACHES ROOM TEMPERATURE!

If the detector package comes into the laboratory from a truck or warehouse where the temperature differs by 5°C (10°F) or more from that of the laboratory, allow the package to reach room temperature before opening. This will prevent fracturing the crystal from thermal shock. A good practice is to leave the package in the laboratory overnight before opening.

If damage to the shipping carton is apparent, ask that the carrier's agent be present when the detector is unpacked, or otherwise document the damage. Saint-Gobain Crystals cannot replace a detector damaged in shipment without this damage report.

Inspect the detector for mechanical damage, scratches, dents, etc. Check any mechanical or thermal shock indicators that may be packed with the detector.

Storage and Thermal Shock –

NEVER STORE THE DETECTOR NEAR A HEATING ELEMENT, SUN-WARMED SURFACE, RADIATOR OR AIR CONDITIONER!

Unless specifically designed to withstand other conditions, Saint-Gobain Crystals detectors are intended for use in a normal laboratory environment. They will operate reliably between 4°C and 43°C (40°F and 110°F), provided the rate of temperature change does not exceed 8°C (15°F) per hour.

Crystal Hydration –

Some crystals are hygroscopic (Refer to Scintillator Properties Chart document) which means they are easily damaged when exposed to moisture in air at normal humidity levels. Some bare crystals can dissolve in room humidity. The hermetic seals used in these assemblies must be protected at all times. For this reason, avoid using strong organic solvents which may dissolve or soften epoxy seals. Similarly, never expose the detector to mechanical shock that may crack or chip the seals.

In NaI(Tl) crystals, hydration first appears as yellow/green spots on the surface and later as a distinct tint to the crystal. Because the hydration is yellow/green, it is an excellent absorber of blue scintillation light and will significantly degrade light output and thereby resolution. Except at low energies, counting efficiency is not normally impaired if the proper electronic adjustments are made.

In CsI(Na), hydration first deactivates the surface of the crystal. Damage produced by a small amount of hydration is not visible to the eye and does not affect resolution at high energies. At low energies, the resolution and efficiency of the detector are drastically impaired — as much as 40% up to 120 keV for a 1mm hydrated layer.

In the BrilLanCe scintillators [$LaCl_3$(Ce) and $LaBr_3$(Ce)], discoloration may not be noticeable, but the detector performance deteriorates.

Other scintillators that are not hygroscopic are also affected by excessive moisture. CsI(pure), CsI(Tl), and BaF_2 crystal surfaces are easily damaged by drops of moisture or excessive condensation.

In general, deterioration of energy resolution or of the absolute efficiency is an indicator of detector degradation.

UV Exposure –

Ultraviolet radiation in sunlight or fluorescent lighting can produce discoloration and phosphorescence in scintillation crystals. The coloration produced by UV radiation appears in the bulk of the crystal rather than the surface and is most noticeable in large crystals. For this reason, open window detectors or unpackaged crystals should be stored in darkness when not in use.

In NaI(Tl), the damage usually appears as a slightly muddy brown color and produces a loss of resolution. BGO is also very sensitive and its performance deteriorates quickly. BGO and NaI(Tl) should be protected from UV and should be stored in the dark. Counting efficiency is not generally impaired, though pulse height decreases and resolution deteriorates.

Light Leaks –

A light leak into the photomultiplier tube (PMT) assembly will cause continuous emission of photoelectrons from the PMT's photocathode when high voltage is on. In the D.C. current mode of operation, this will result in an increased signal that can be detected by switching the room lights on and off.

In the pulse mode of operation, light leaks can be detected by looking at the system's output with an oscilloscope. Set the sweep speed at approximately 5 µsec/cm and trigger on the smallest possible pulse (high vertical gain, but above the electronic noise level). Switch the room lights on and off again, looking for changes in the trigger rate.

SAINT-GOBAIN

Saint-Gobain Crystals

www.crystals.saint-gobain.com